

NEW RECORDS AND CLARIFICATIONS OF THE PENNSYLVANIA STONEFLY (PLECOPTERA) FAUNA, WITH AN ANNOTATED LIST OF THE STONEFLIES OF PENNSYLVANIA, U.S.A.¹

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ABSTRACT: Five species, *Nemoura trispinosa* Claassen, *Strophopteryx appalachia* Ricker and Ross, *Alloperla biserrata* Nelson and Kondratieff, *Neoperla robisoni* Poulton and Stewart, and *Neoperla choctaw* Stark and Baumann, are added to the Pennsylvania fauna. Five species, *Allocapnia wrayi* Ross, *Leuctra carolinensis* Claassen, *Tallaperla anna* (Needham and Smith), *Tallaperla elisa* Stark, and *Malirekus hastatus* (Banks) are deleted. An annotated list of the 133 described Pennsylvania stonefly species is presented.

KEY WORDS: Stoneflies, Plecoptera, Pennsylvania (U.S.A.), new records, clarifications, ecoregions

Surdick and Kim (1976) published the first definitive review of the Pennsylvania stonefly fauna, recording 90 species in nine families and 32 genera. Stark et al. (1986) reported 94 species in Pennsylvania. Earle (1994) added 14 species and deleted four species previously added in error. Masteller (1996a) added 17 species, deleted five species, and presented an annotated list of Pennsylvania species that included 131 described species plus three undescribed *Isoperla* species. Grubbs and Stark (2001) added two *Perlesta* species, *P. nelsoni* Stark and *P. teaysia* Kirchner and Kondratieff, bringing the Pennsylvania list to 133 described species.

Five species are added herein to the Pennsylvania list: *Nemoura trispinosa* Claassen, *Strophopteryx appalachia* Ricker and Ross, *Alloperla biserrata* Nelson and Kondratieff, *Neoperla robisoni* Poulton and Stewart, and *Neoperla choctaw* Stark and Baumann. Five species added in error are deleted: *Allocapnia wrayi* Ross, *Leuctra carolinensis* Claassen, *Tallaperla anna* (Needham and Smith), *Tallaperla elisa* Stark, and *Malirekus hastatus* (Banks). With these additions and deletions, the Pennsylvania stonefly fauna total remains at 134 described species; however, since several more soon to be described species will be added to the Pennsylvania list within the next few years, the Pennsylvania species list could approach 140.

Collections of new species records presented are by the author. New county records are capitalized. An annotated list of Pennsylvania species is presented in Table 1. Voucher specimens will be placed at the Academy of Natural Sciences of Philadelphia. Ecoregion information is from Woods et al. (1996).

¹ Submitted on June 2, 2004. Accepted on September 19, 2004.

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ADDITIONS

Nemouridae: *Nemoura trispinosa*: MONROE COUNTY: Red Run, Industrial Road (41°07' 42"N, 75°22'48"W), one female, May 15, 2003. This is a small, low gradient stream with a swampy riparian area. Red Run is in the Pocono High Plateau section of the North Central Appalachians Ecoregion, which is a low relief, forested highland with many lakes and low gradient streams with few riffles (Woods et al. 1996). *N. trispinosa* is distributed across the northern US and Canada, west to Manitoba and Wyoming and south to Ohio (Stark 2001).

Taeniopterygidae: *Strophopteryx appalachia*: HUNTINGDON COUNTY: Shade Creek near Orbisonia (40°12'19"N, 77°52'39"W), one male, April 25, 1994; FULTON COUNTY: Tonoloway Creek, SR 2005 (39°43'41"N, 78°09'08"W), 28 March 2003, 6 males; Sideling Hill Creek, PA Route 484 (39°44'35"N, 78°21' 33"W), 28 March 2003, one male and one female; BEDFORD COUNTY: Town Creek at Blues Gap Road (39°46'45"N, 78°30'12"W), one female. Shade Creek is a 3rd order limestone influenced stream in the Susquehanna River basin; the other streams are 4th order streams in the Potomac River basin. All are within the Ridge and Valley Ecoregion. The two northeastern species of *Strophopteryx* are apparently sympatric at least through part of their range, since one male *Strophopteryx fasciata* (Burmeister) was collected at the Tonoloway Creek site and from another nearby stream, Little Tonoloway Creek. Stewart (2000) reported that *S. appalachia* is found in the Appalachian Mountain region from West Virginia south to South Carolina. A northern range extension of *S. appalachia* into the Potomac River basin Maryland was recorded by Grubbs (1997). This record extends the northern limit of this species into southcentral Pennsylvania and the lower edge of the Susquehanna River basin. No other specimens of *S. appalachia* have so far been identified from farther north in Pennsylvania.

Chloroperlidae: *Alloperla biserrata*: BEDFORD COUNTY, Blackberry Lick Creek, PA, Route 26 (39°47'05"N, 78°24'23"W), one male, May 17, 2002. Blackberry Lick Creek is a 2nd order, largely forested stream in the Ridge and Valley Ecoregion, Potomac River basin. This is the ninth described species of *Alloperla* now recorded from Pennsylvania. *A. biserrata* was described from collections from several small streams in Virginia (Nelson and Kondratieff 1980). Since the initial description, *A. biserrata* has also been reported from Maryland and West Virginia (Grubbs 1997 and Stark 2001).

Perlidae: The Nearctic *Neoperla* were for many years believed to be one variable, widespread species, *Neoperla clymene* (Newman), until Stark and Baumann (1978) described several new species and removed several others from synonymy with *N. clymene*, resulting in eight North American species. Subsequent researchers described several more species, bringing the total number of North American species to 15 (Stark 1990 and DeWalt et al. 2002). Masteller (1996a) reported 4 species of *Neoperla* from Pennsylvania, *N. clymene*, *Neoperla catharae* Stark and Baumann, *Neoperla occipitalis* (Pictet), and *Neoperla stewarti* Stark and Baumann. The following two additional species will bring the Pennsylvania *Neoperla* species total to six.

Neoperla robisoni: BERKS COUNTY: Maiden Creek, PA, Route 143, ½ mile north of I-78 (40°34'55"N, 75°53'27"W) one male, June 27, 2000; PERRY COUNTY: Susquehanna River, Marysville (40°21'04"N, 76°55'51"W), one male, July 17, 1993 and one male July 25, 1998; Juniata River, Greenwood boat access (40°31'48"N, 77°08'33"W) one male, June 24, 1994. All locations are in the Ridge and Valley Ecoregion. *N. robisoni* was described by Poulton and Stewart from the Ozark Mountains (Ernst et al. 1986). These Pennsylvania records represent a range extension farther northeast from the previous northern limit, the Potomac River in Maryland (Grubbs 1997) and into the Susquehanna and Delaware River basins of Pennsylvania. The Pennsylvania and Maryland collections of *N. robisoni* are from medium to large, swift, rocky creeks and rivers. The other records are from large, lowland streams in the southeastern United States, from Mississippi to Tennessee (Grubbs 1997).

Neoperla choctaw: CUMBERLAND COUNTY: Conodoguinet Creek, Mountain Road (40°09'06"N, 77°30'00"W), 3 females, August 6, 1998. PERRY COUNTY: Susquehanna River, Marysville (40°21'04"N, 76°55'51"W) one female with eggs, July 13, 2002. The Pennsylvania habitats are large warm water creeks and rivers in the Ridge and Valley Ecoregion of the Susquehanna River basin. These records extend the distribution of *N. choctaw* north from its previously reported distribution of Arkansas, Missouri, Oklahoma, and West Virginia (Stark 2001). *N. choctaw* adults have distinctive coloring; the wings are dark brown to black and the body is checkered black and orange.

DeWalt et al (2002) reported that *Neoperla* are found in relatively clean streams and that 4 of the 7 species historically known from Illinois are now extirpated and 2 others have had significant reductions in range. The presence of the six *Neoperla* species currently in Pennsylvania is a testament to the good quality water of many of our larger creeks and rivers. *Neoperla*, however, have been under-collected as both nymphs and adults in Pennsylvania. Additional collecting in their preferred habitat should provide a better picture of their true distribution and abundance in Pennsylvania.

CORRECTIONS

Stark (2001) and Stewart and Stark (2002) presented compilations of state records for the North American stonefly species. Not all the additions and deletions presented in Earle (1994) and Masteller (1996a) were reflected in their lists. I present the following corrections to the Pennsylvania stonefly list based on review of publications that included PA species records and examination of questionable species believed to be misidentifications. Only misidentifications or species listed in error will be discussed below. An annotated species list is presented in Table 1.

Capniidae: Kondratieff and Kirchner (1982) described *Allocapnia wrayi* as a common winter stonefly east of the Appalachian Mountains ranging from Maryland to Georgia. Ross and Ricker (1971) described *A. wrayi* as a coastal plain species. *A. wrayi* was added to the Pennsylvania stonefly list by Masteller

(1996a and b) based on collections from 3 streams, two east and one west of the Appalachians. Specimens from these three locations have been examined and determined to be misidentifications of either *Allocaepnia pygmaea* (Burmeister) or *Allocaepnia recta* (Claassen). In addition, extensive sampling for winter stoneflies throughout Pennsylvania has not yielded any additional specimens of *A. wrayi*. *A. wrayi* should, therefore, be deleted from the Pennsylvania stonefly list.

Surdick and Kim (1976) listed several locations for *Paracapnia opis* (Newman) from collections made in 1937. For many years, the two *Paracapnia* species had been confused and described under several names until the description of *Paracapnia angulata* Hanson in 1961 (Hitchcock 1974). No additional *P. opis* adults have been identified from Pennsylvania; therefore, *P. opis* should not be considered part of the PA stonefly fauna.

Leuctridae: Surdick and Kim (1976) placed *Leuctra carolinensis* on the Pennsylvania species list based on five males and one female collected from one stream in Lackawanna County in northeastern Pennsylvania in 1945. I examined these specimens and identified them as *Leuctra tenella* Provancher. Masteller (1996a) added an additional *L. carolinensis* record based on collections from one stream in Tioga County in northcentral Pennsylvania by visiting scientists from the southeastern U.S. where *L. carolinensis* is a common species. *L. tenella* and *L. carolinensis* are similar species that have been confused and listed in error in other states (Kondratieff et al. 1995). Since *L. carolinensis* is considered a southern Appalachian species distributed from Maryland south to South Carolina (Stark 2001 and Kondratieff et al. 1995) and no additional specimens have been discovered in Pennsylvania after many years of sampling, *L. carolinensis* should be deleted from the PA list.

Peltoperlidae: *Tallaperla anna* was added to the Pennsylvania list in error and should be deleted. *T. anna* is restricted to the southern Appalachian Mountains of Virginia, North Carolina, South Carolina, and Georgia (Stark 2000). *T. anna* was included on the Pennsylvania species list in Surdick and Kim (1976) based on a collection from one stream in Luzerne County in northeastern Pennsylvania in 1949. Stark (personal communication) believes that he examined these specimens during his review of *Tallaperla* and identified them as *Tallaperla maria* (Needham and Smith). The National Museum of Natural History (Smithsonian Institution, Washington, DC), which is listed as the repository for the Pennsylvania specimen, has no current record of a *T. anna* from Pennsylvania (O.S. Flint, Smithsonian Institution, pers. comm.). No additional *Tallaperla* adults have been identified as *T. anna* since the 1949 collection. Considering the confirmed limited southern distribution, lack of additional records, and the difficulty of separating the very similar *Tallaperla* species, *T. anna* should be deleted from the Pennsylvania species list.

Tallaperla elisa was also added to the Pennsylvania list in error. Masteller (1996a) included *T. elisa* on his Pennsylvania stonefly list based on collections from one stream, Lyman Run, Tioga County in northcentral Pennsylvania by visiting scientists from the southern Appalachians. I collected several male *Talla-*

perla from Lyman Run and several nearby streams in May 1998, all of which were identified as *T. maria*. The Lyman Run *T. elisa* specimens were reexamined by the original collector who now believes that they are *T. maria* (C.H. Nelson, personal communication). *T. elisa* has been confirmed from only high elevation streams along the North Carolina and Tennessee border (Stark 2000 and personal communication). Additionally, Kondratieff et al (1995) considered *T. elisa* to so be rare through its range as to be considered for endangered species status. *T. elisa*, therefore, should be deleted from the Pennsylvania species list.

Grubbs (1997) included *T. elisa* as part of the stonefly fauna of Maryland; however, this record was based on nymphs and exuvia reported from one Maryland stream in Duffield and Nelson (1993). Since *Tallaperla* nymphs cannot be reliably identified to species and Grubbs did not collect any additional specimens in Maryland, *T. elisa* should not be considered part of the Maryland fauna.

Perlodidae: *Yugus bulbosus* (Frison) was the only Pennsylvania *Yugus* species included in Masteller (1996a). The revision of the genus by Nelson (2001) described two new species in the *Y. bulbosus* complex. Nelson described the distribution of *Y. bulbosus* as the southern Appalachians of Georgia, North Carolina, and Tennessee, the distribution of one of the new species, *Yugus kondratieffi* Nelson, as Virginia and North Carolina, and the distribution of the other new species, *Yugus kirchneri* Nelson, as Pennsylvania, West Virginia, and Virginia. *Yugus* adults are extremely elusive; the only confirmed Pennsylvania adult records are from Powdermill Run in Westmoreland County in southwestern Pennsylvania (Masteller 1996b), which Nelson examined and confirmed as *Y. kirchneri*. Nelson confirmed an additional Pennsylvania record for *Y. kirchneri*, a nymph collected in POTTER COUNTY, Bell Branch (41°29'00"N, 77°53'39"W), 14 May 1976.

Pennsylvania was included in the distribution list for *Yugus arimus* (Frison) in Stewart and Stark (2002). This listing is believed to be based on an erroneous listing in Stark et al. (1986) and was deleted by Earle (1994). The only confirmed Pennsylvania species of *Yugus*, therefore, should be *Y. kirchneri*.

Surdick and Kim (1976) listed two species of *Isogenoides*: *Isogenoides doratus* (Frison) and *Isogenoides hansonii* (Ricker) in Pennsylvania. The *I. doratus* record in Surdick and Kim (1976) was based on collections by Jennings in 1942 and published in Frison (1942). Ricker (1952) described a new species, *I. hansonii*, using the Jennings Pennsylvania specimens and location as the holotype and type locality. Ricker (1952) stated that *I. doratus* was a Midwestern United States species. In addition to the above two *Isogenoides* species, Stark (2001) and Stewart and Stark (2002) also included *Isogenoides olivaceus* (Walker) as part of the Pennsylvania fauna. I have not found any records of this species in Pennsylvania in the literature or collections. Ricker (1952) listed the distribution of *I. olivaceus* as northern Wisconsin, Michigan, Ontario and Quebec. Minnesota is the only additional valid state record for this species in Stewart and Stark (2002). *I. hansonii* should be considered the only valid *Isogenoides* species in Pennsylvania.

Malirekus was considered a monotypic genus until the revision by Stark and Szczytko (1988) that established a new species, *Malirekus iroquois* Stark and Szczytko. They considered the two species to be allopatric, with *M. hastatus* occurring in the southeastern U.S. and *M. iroquois* in the northeastern U.S. and Canada, but cautioned that additional specimens from the mid-Atlantic region would need to be examined to determine the north-south limits of these two species. Grubbs (1997) did not find any *M. hastatus* in Maryland and suggested the North Branch Potomac River in West Virginia as the northern limit of *M. hastatus*.

The only published Pennsylvania record of *M. hastatus* is from the Stroud Research Center in Chester County Pennsylvania (Masteller 1996b), which was a reared specimen of questionable origin (D. Funk, Stroud Research Center, pers. comm.). *Malirekus* adults are rarely collected; however, nymphs are regularly collected from small streams throughout Pennsylvania. No adults collected so far in Pennsylvania have been positively identified as *M. hastatus*. *Malirekus* females are difficult to verify without examination of the eggs; however, the subgenital plates of the Pennsylvania females are consistent with *M. iroquois* (B.P. Stark pers. comm.). All nymphs collected so far in Pennsylvania have lacked the submental gills described by Stark and Szczytko (1998) as present on nymphs of southern populations of *M. hastatus*. *M. hastatus* should, therefore, be deleted from the PA stonefly list. New confirmed Pennsylvania records of *M. iroquois* are as follows: SULLIVAN COUNTY, Painter Run (41°19'22"N, 76°27'16"W), one male, May 29, 1977 (listed as *M. hastatus* in Kondratieff 2004); TIOGA COUNTY, unnamed tributary to Babb Creek at old village of Landrus (41°38'20"N, 77°12'25"W), one late instar male nymph with visible genitalia, June 16, 1993; WESTMORELAND COUNTY, Roaring Run, near Camp Alliquippa (40°04'09"N, 79°20'39"W, 21 May 1997, one female.

Pteronarcyidae: Nelson (2000) in Volume I of the series *Stoneflies (Plecoptera) of Eastern North America* listed the distribution of *Pteronarcys scotti* Ricker, one of the six Eastern North American *Pteronarcys* species, as Georgia, North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia. This inclusion of *P. scotti* as part of the Pennsylvania fauna was based on Surdick and Kim (1976) who listed a record of *P. scotti* nymphs from one Pennsylvania stream. Masteller (1996b) reported that *P. scotti* was added in error and he did not include it in his list of the Pennsylvania stonefly fauna. No adult *P. scotti* have been collected in Pennsylvania to confirm its presence, or from the adjacent states of Maryland and West Virginia (Grubbs 1997). *P. scotti* should, therefore, properly be considered a southern Appalachian species and not part of the Pennsylvania fauna.

ACKNOWLEDGMENTS

I would like to thank Dr. Bill P. Stark, Mississippi College, for verification of the *Neoperla* and *Malirekus* identifications and review of the manuscript, and Dr. Boris C. Kondratieff, Colorado State University, for review of the manuscript. I would also like to thank the Smithsonian Institution, National Museum of Natural History, Washington, D.C. for loan of specimens. Thanks are also expressed to three anonymous reviewers.

NOTE

The publication of Surdick (2004) after the completion of this paper resulted in a change: *Alloperla petasata* Surdick replaces *Alloperla caudata* Frison in Pennsylvania. The species list accompanying this paper has been adjusted accordingly.

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Table 1. Annotated list of the 134 Pennsylvania stonefly species.**Capniidae**

Allocaupnia aurora Ricker
Allocaupnia curiosa Frison
Allocaupnia frisoni Ross and Ricker
Allocaupnia granulata (Claassen)
Allocaupnia harperi Kirchner
Allocaupnia maria Hanson
Allocaupnia nivicola (Fitch)
Allocaupnia pechunani Ross and Ricker
Allocaupnia pygmaea (Burmeister)
Allocaupnia recta (Claassen)
Allocaupnia rickeri Frison
Allocaupnia simmonsii Kondratieff and Voshell
Allocaupnia vivipara (Claassen)
Allocaupnia zola Ricker
Paracupnia angulata Hanson

Leuctridae

Leuctra alexanderi Hanson
Leuctra duplicata Claassen
Leuctra ferruginea (Walker)
Leuctra grandis Banks
Leuctra maria Hanson
Leuctra sibleyi Claassen
Leuctra tenella Provancher
Leuctra tenuis (Pictet)
Leuctra truncata Claassen
Leuctra variabilis Hanson
Paraleuctra sara (Claassen)
Megaleuctra flinti Baumann

Nemouridae

Amphinemura appalachia Baumann
Amphinemura delosa (Ricker)
Amphinemura linda (Ricker)
Amphinemura nigrifluta (Provancher)
Amphinemura wui (Claassen)
Nemoura trispinosa Claassen
Ostrocerca albidipennis (Walker)
Ostrocerca complexa (Claassen)
Ostrocerca prolongata (Claassen)
Ostrocerca truncata (Claassen)
Paranemoura perfecta (Walker)
Prostoia completa (Walker)
Prostoia similis (Hagen)
Soyedina carolinensis Claassen
Soyedina merritti Baumann and Grubbs
Soyedina vallicularia (Wu)
Soyedina washingtoni (Claassen)

Taeniopterygidae

Bolotoperla rossi (Frison)
Oemopteryx contorta (Needham and Claassen)
Strophopteryx appalachia Ricker and Ross
Strophopteryx fasciata (Burmeister)
Taenionema atlanticum Ricker and Ross
Taeniopteryx burksi Ricker and Ross
Taeniopteryx maura (Pictet)
Taeniopteryx metequi Ricker and Ross
Taeniopteryx nivalis (Fitch)
Taeniopteryx parvula Banks
Taeniopteryx ugola Ricker and Ross

Peltoperlidae

Peltoperla arcuata Needham
Tallaperla maria (Needham and Smith)

Chloroperlidae

Alloperla aracoma Harper and Kirchner
Alloperla atlantica Baumann
Alloperla biserrata Nelson and Kondratieff
Alloperla chloris Frison
Alloperla concolor Ricker
Alloperla imbecilla (Say)
Alloperla petasata Surdick
Alloperla usa Ricker
Alloperla vostoki Ricker
Haploperla brevis (Banks)
Rasvena terna (Frison)
Suwallia marginata (Banks)
Sweltsa lateralis (Banks)
Sweltsa naica (Provancher)
Sweltsa onkos (Ricker)
Utaperla gaspesiana Harper and Roy

Perlidae – Acroneuriinae

Acroneuria abnormis (Newman)
Acroneuria arenosa (Pictet)
Acroneuria arida (Hagen)
Acroneuria carolinensis (Banks)
Acroneuria evoluta Klapalek
Acroneuria filicis Frison
Acroneuria frisoni Stark and Brown
Acroneuria lycorias (Newman)
Attaneuria ruralis (Hagen)
Eccopteryx xanthenes (Newman)
Hansoperla appalachia Nelson
Perlesta decipiens (Walsh)
Perlesta nelsoni Stark

Perlesta nitida Banks
Perlesta placida (Hagen)
Perlesta teasyia Kirchner and Kondratieff
Perlinella drymo (Newman)
Perlinella ephyre (Newman)

Perlidae – Perlinae

Neoperla catharae Stark and Baumann
Neoperla choctaw Stark and Baumann
Neoperla clymene (Newman)
Neoperla occipitalis (Pictet)
Neoperla robisoni Poulton and Stewart
Neoperla stewarti Stark and Baumann
Agnestina annulipes (Hagen)
Agnestina capitata (Pictet)
Agnestina flavescens (Walsh)
Paragnetina immarginata (Say)
Paragnetina media (Walker)

Perlodidae – Isoperlinae

Clioperla clio (Newman)
Isoperla bilineata (Say)
Isoperla dicala Frison
Isoperla francesca Harper
Isoperla frisoni Illes
Isoperla holochlora (Klapalek)
Isoperla lata Frison
Isoperla marlynia (Needham and Claassen)

Isoperla montana (Banks)
Isoperla namata Frison
Isoperla nana (Walsh)
Isoperla orata Frison
Isoperla richardsoni Frison
Isoperla signata (Banks)
Isoperla similis (Hagen)
Isoperla slossonae (Banks)
Isoperla transmarina (Newman)

Perlodidae – Perlodinae

Cultus decisis decisis (Walker)
Cultus verticalis (Banks)
Diploperla duplicata (Banks)
Diploperla robusta Stark and Gaufin
Remenus bilobatus (Needham and Claassen)
Helopicus subvarians (Banks)
Isogenoides hansonii (Ricker)
Malirekus iroquois Stark and Szczytko
Yugus kirchneri Nelson

Pteronarcyidae

Pteronarcys biloba Newman
Pteronarcys comstocki Smith
Pteronarcys dorsata (Say)
Pteronarcys pictetii Hagen
Pteronarcys proteus Newman